EuroSciCon

July 16-17, 2018
Prague, Czech Republic

EuroSciCon Joint Event on
Laser Optics & Photonics and Atomic & Plasma Science

Am J Compt Sci Inform Technol 2018, Volume 6
DOI: 10.21767/2349-3917-C1-003

PROCESS AND COATING DEVELOPMENT FOR PECVD COATED PLASTICS PRODUCTS

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The largest field of application for plastics is currently in packaging, as they offer good mechanical properties combined with low density. A drawback of plastic packaging for food, pharmaceuticals and electronics applications over metals or glass is often their permeability to oxygen, carbon dioxide, water vapour and aroma. In order to improve this property, nano-scaled plasma deposited barrier coatings are researched. These are able to form virtually impermeable layer on the substrate and reduce permeation. Thanks to developments in low-pressure technology, surface functionalization by means of plasma is economically viable for mass-produced products nowadays, which is demonstrated by numerous examples such as the inner coating of polyethylene pipes, polypropylene syringes or polyethylene terephthalate bottles, polypropylene jam cups or coffee capsules. For example, polyethylene terephthalate bottles are coated with a barrier layer immediately after stretch blow molding before they are filled. Right after injection moulding, polypropylene cups are barrier-coated in batch processes. Functionalization processes for mass production start with a laboratory reactor in which functionalities are developed on small, mostly two-dimensional substrates. Subsequent to that, the process must be transferred to complex geometries and finally scaled up to viable sizes for mass production. Therefore a knowledge-based, systematic process and coating development is required which can be separated into product, plasma process and system properties, which are linked to each other via surface and coating analysis. Surface and coating analysis is mandatory for the definition of substrate-based challenges to the plasma process, tailoring the plasma process to the substrates particularities and testing the product properties. In addition, surface analytical methods are used to determine the influence of process parameters on coating properties and to achieve the defined target values of surface functionality. Systematic upscaling of the plasma process represents a decisive step towards mass-produced applications for the process integration of the developed functionalities.

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